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ABSTRACT

This is the fourth of six guidebooks on minimum course content for first-year algebra; it includes first degree equations involving absolute value, radicals, various approaches to solving quadratics, and problem solving with quadratics. After course goals are stated, a listing of performance objectives, a course outline, textbook references, and teaching suggestions are given. Pretest and posttest items are included, plus an annotated list of three references. For other booklets in the series, see SE 014 897 and SE 014 874. (DT)

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

Algebra 1 s

5215.14

Mathematics

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

QUINMESTER MATHEMATICS

COURSE OF STUDY

FOR

ALGEBRA 1s

5215.14

(EXPERIMENTAL)

Written by

Patricia Rose

for the

DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Florida 33132
1971-72

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PREFACE

The following course of study has been designed to set a minimum standard for student performance after exposure to the material described and to specify sources which can be the basis for the planning of daily activities by the teacher. There has been no attempt to prescribe teaching strategies; those strategies listed are merely suggestions which have proved successful at some time for some class.

The course sequence is suggested as a guide; an individual teacher should feel free to rearaange the sequence whenever other alternatives seem more desirable. Since the course content represents a minimum, a teacher should feel free to add to the content specified.

Any comments and/or suggestions which will help to improve the existing curriculum will be appreciated. Please direct your remarks to the Consultant for Mathematics.

All courses of study have been edited by a subcommittee of the Mathematics Advisory Committee.

CATALOGUE DESCRIPTION

Further work in open sentences and problem solving and an introduction to radicals. Includes first degree equations involving absolute value, various approaches to solving quadratics, and problem solving involving quadratics.

Designed for the student who has mastered the skills and concepts of Algebra 1r.

TABLE OF CONTENTS

OVERALL GOALS

The student will:

1. Strengthen his mathematical background necessary for success in higher mathematical courses such as Geometry and Algebra II.

2. Strengthen his ability to set up and solve word problems involving equations and inequalities.

3. Develop an appreciation for practical applications of algebra.

KEY TO REFERENCES

(* State Adopted)

* D - Dolciani, Mary; Wooten, William; Beckenbach, Edwin; Jurgensen, Ray; and Donnelly, Alfred. Modern School Mathematics, Algebra 1. New York: Houghton Mifflin, 1967.

N - Nichols, Eugene D., Modern Elementary Algebra. New York: Holt, Rinehart, and Winston, 1961.

* PL - Payne, Joseph; Zamboni, Floyd; and Lankford, Francis. Algebra One. New York: Harcourt, Brace, Jovanovich, 1969.

* PA - Pearson, Helen R. and Allen, Frank B. Modern Algebra: A Logical Approach, Book One. Boston: Ginn and Co., 1964.

[1] - The number in the block preceeding an objective indicates the number of the state assessment standard to which the objective is related.

PERFORMANCE OBJECTIVES

I. Open Sentences of First Degree

The student will:

[3] 1. Solve one-variable, first-degree equations and inequalities involving absolute value, over specified subsets of the real numbers, and graph the solution sets.

2. Solve one-variable, first-degree compound sentences and graph the solution sets.

3. Solve equations involving rational expressions composed of first-degree polynomials in one variable.

[12] 4. Solve problems using rational expressions composed of first degree polynomials in one variable.

5. Solve multi-variable rational equations for one of the variables when the rational expressions are composed of first-degree polynomials.

II. Radicals

The student will:

1. Change radical expressions to exponential form.

[8] 2. Apply the laws of exponents in simplifying an expression containing fractional exponents.

3. Rewrite in radical form an expression containing fractional exponents.

4. Compute approximations of square roots using the averaging method and/or the algorithm.

[12] 5. Solve problems using the Pythagorean theorem.

III. Open Sentences of Second Degree

The student will:

1. Write a quadratic equation in standard form.

[10] 2. Solve quadratic equations by factoring.

[10] 3. Solve quadratic equations by completing the square.

[10] 4. Solve quadratic equations by using the quadratic formula.

5. Use the discriminant to determine the nature of the roots of a quadratic equation.

[12] 6. Solve problems involving quadratic equations.

PERFORMANCE OBJECTIVE	COURSE OUTLINE
I.	I. Open Sentences of First Degree
1	A. Equations and inequalities in one variable involving absolute value
	1. Solution by cases
	2. Graphing the solution set
2	B. Single variable compound sentences
	1. Intersection and union
	2. Graphing the solution set
3, 4	C. Equations involving rational expressions composed of first degree polynomials
	1. Solution
	2. Word problems
5	D. Multi-variable rational equations
	1. Solve for one of the variables
II.	II. Radicals
1, 3	A. Exponential form
	1. Change a radical expression to exponential form
	2. Change an expression from exponential form to radicals
2	B. Simplifying expressions with fractional exponents
	1. Laws of exponents
4	C. Square root
	1. Averaging method
	2. Algorithm
5	D. Pythagorean theorem

PERFORMANCE OBJECTIVE	COURSE OUTLINE
III.	III. Open Sentences of Second Degree
1,2,3,4,5,6	A. Quadratic equations
	1. Write in standard form
	2. Solution
	a. Factoring b. Completing the square c. Quadratic formula
	3. Use of discriminant to analyze roots
	4. Word problems

TEXTBOOK REFERENCES

Course Outline	D	N	PL	PA
I. A	165-168	186-188	148-151	217-219, 224-226, 308-309
B	160-165	182-185, 241-246	144-148, 122-127	68-74, 91, 93
C	345-353	194-196, 203-206	422-429	154-156, 190-196
D	134	217-220	430-434, 142-143	301-306
II. A	466-469	332-336	273-275	526-529
B	466-469	332-336	273-275	526, 529
C	427-430 (Only averaging method)	71-75 (Only averaging method)	275-278 (Only averaging method)	519-525 (Algorithm method)
D	431-437	75-79, 421-423	38-42	444-445, 532-536
III. A	448-460, 292-300	361-374	358-378	389-395, 592-593

SUGGESTED STRATEGIES

I. 1. Graphing the solution set of absolute value problems is helpful in visualizing the problem and the solution.

2. The use of quantifiers should be stressed in equations or inequalities.

3. Graphing the solution set of inequalities helps the student to better visualize the problem and the solution.

4. Insert word problems as often as possible in each section.

5. Stress to the students that the solution set of identity equations is equal to the replacement set.

6. Include in assignments and tests equations whose solution sets are the empty set.

7. Have students solve for one variable in terms of the other variables in formulas of science which are multi-variable.

II. 1. When computing approximations of square roots, students should be taught the advantages of both methods and how to determine which method should be used.

2. Stress the difference in solution sets between $(4x)^{\frac{1}{2}}$ and $4x^{\frac{1}{2}}$.

III. 1. The students should be taught the advantages of each method of solving quadratic equations and which method is best for each equation.

2. The use of the discriminant to analyze roots of the equation should be explained thoroughly to the students.

SAMPLE PRETEST ITEMS

I. 1. Multiply and simplify: $(3x^4)(5x^9)$

2. Simplify: $(2x^3)^4$

3. Simplify: $\dfrac{15x^9y^5}{3x^2y^7}$

4. Find the following products mentally:

a) $(3x + 4)(3x - 4)$ b) $(4x - 5)^2$

c) $(2x + 3)(9x - 4)$

5. Factor the following completely:

a) $4x^2 - 25$

b) $16x^2 + 40x + 25$

c) $x^2 - 3x - 28$

d) $6x^2 + 39x + 63$

e) $6x^2 + 45x + 21$

6. Divide: $3x^2 - 25x - 18$ by $x - 9$

II. 1. Evaluate: $\dfrac{3x + 4}{9 - x^2}$ for $x = 2$

2. What are the restrictions on $\dfrac{9 + x^2}{25 - x^2}$?

3. Reduce: $\dfrac{4K^2 - 4K - 24}{10K^2 + 55K + 70}$

4. Is $\dfrac{x^2 + 5x - 3}{x - 8}$ equivalent to $\dfrac{3 - 5x - x^2}{8 - x}$?

5. Multiply and simplify:

$$\frac{a^2 - b^2}{a + 2} \cdot \frac{a^2 + 5a + 6}{a + b}$$

6. Divide and simplify:

$$\frac{5a^2 - 5ab}{ab + b^2} \div \frac{5a^2 - 5b^2}{b}$$

7. Perform the following operations and simplify:

a) $\frac{9 + a}{ab} + \frac{7}{ab}$ b) $\frac{x^2}{x + y} - \frac{y^2}{x + y}$

8. Find the LCM of the following:

$y^2 - 2y - 8$; $3y^2 - y - 14$; $y^2 + 14y + 24$

9. Perform the following operations and simplify:

a) $\frac{x - 1}{x + 2} + \frac{5}{x - 2}$ b) $\frac{a}{3b} - \frac{c}{d + 2}$

KEY TO PRETEST

I. 1. $15x^{13}$

2. $16x^{12}$

3. $\frac{5x^7}{y^2}$

4. a) $9x^2 - 16$

b) $16x^2 - 40x + 25$

c) $18x^2 + 19x - 12$

5. a) $(2x + 5)(2x - 5)$

b) $(4x + 5)^2$

c) $(x - 7)(x + 4)$

d) $(3x + 9)(2x + 7)$

e) $3(2x + 1)(x + 7)$

6. $(3x + 2)$

II. 1. 2

2. $x \neq 5, -5$

3. $\frac{4(K - 3)}{5(2K + 7)}$ or $\frac{4K - 12}{10K + 35}$

4. Yes

5. $(a - b)(a + 3)$ or $a^2 - ab + 3a - 3b$

6. $\frac{a}{(a + b)^2}$ or $\frac{a}{a^2 + 2ab + b^2}$

7. a) $\frac{16 + a}{ab}$

b) $x - y$

II. 8. $(y + 2)(y - 4)(3y - 7)(y + 12)$

9. a) $\dfrac{x + 2x + 12}{x - 4}$

b) $\dfrac{ad + 2a - 3bc}{3b(d + 2)}$ or

$\dfrac{ad + 2a - 3bc}{3bd + 6b}$

SAMPLE POSTTEST ITEMS

(Keyed to Objectives)

I. 1. Solve the following for x and graph the solution set:

a) $|2x + 3| = 5$ b) $|x - 4| + 6 = 2$

c) $|2x + 1| \geq 2$

2. Solve for x and graph the solution set:

$$9 < 2x + 3 \leq 14$$

3. Solve for y:

$$3 = \frac{4y}{y + 2}$$

4. Find two consecutive odd integers such that the ratio of the first to the second is $\frac{2}{17}$ less than one.

5. Solve for b:

$$\frac{3b + c}{2d} = 7$$

II. 1. Change to exponential form:

a) $\sqrt{3x}$ b) $4\sqrt{y}$

2. Simplify:

a) $(36x^2)^{\frac{1}{2}}$ b) $(4x^{\frac{1}{2}})(5x^3)$

3. Rewrite in radical form:

a) $3x^{\frac{1}{2}}$ b) $(9x^2)^{\frac{1}{3}}$

4. Find the square root of 72 to the nearest tenth.

5. Find the length of the other leg of a right triangle if one side is 8" and the hypotenuse is 17".

III. 1. Write in standard form:

$$15 + 2x^2 + 9 = 5x$$

2. Solve by factoring:

$$6x^2 - 6 = 5x$$

3. Solve by completing the square:

$$y^2 - 8y + 3 = 0$$

4. Solve by the quadratic formula:

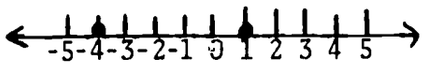
$$13x + 5x^2 + 2 = 0$$

5. If the discriminant ($b^2 - 4ac$) is equal to zero, what do you know about the nature of the roots of the equation?

6. The length of a room is seven feet more than the width. The area is 198 square feet. Find the length and width.

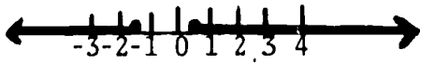
KEY TO POSTTEST

I. 1. a) 1, -4

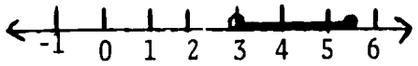


b) $\emptyset$

c) $x \geq \frac{1}{2}$ or $x \leq \frac{-3}{2}$



2. $3 < x \leq \frac{11}{2}$



3. 6

4. 15, 17

5. $\frac{14d - c}{3}$

II. 1. a) $(3x)^{\frac{1}{2}}$ b) $4y^{\frac{1}{2}}$

2. a) $6|x|$ b) $20x\sqrt[3]{x}$

3. a) $3\sqrt{x}$ b) $\sqrt[3]{9x^2}$

4. 8.5

5. 15"

III. 1. $2x^2 - 5x + 24 = 0$

2. $\frac{-2}{3}$, $\frac{3}{2}$

3. $4 \pm \sqrt{13}$

4. $\frac{-13 \pm \sqrt{129}}{10}$

5. One distinct real solution (2 equal, real solutions)

6. width = 11 feet , length = 18 feet

ANNOTATED BIBLIOGRAPHY

1. Dodes, Irving A. and Greitzer, Samuel L. Algebra 1: Its Structure, Logic, and Methods. New York: Hayden, 1967.

   Good examples and strategies

2. Dressler, Isidore. Ninth Year Mathematics. New York: Amsco School Publications, 1966.

   Additional problems for tests or assignments and good explanations

3. Manheimer, Wallace. Mastering Elementary Algebra. New York: Oxford, 1960.

   Several extra problems to supplement homework or tests.